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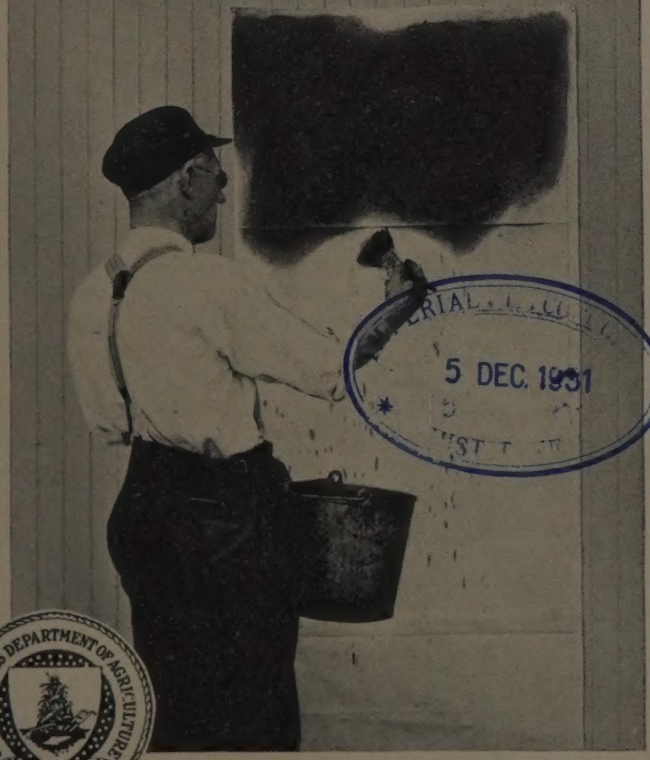
WATERPROOFING AND MILDEWPROOFING OF COTTON DUCK



5 DEC. 1931

ONLY unbleached, unsized, closely woven duck should be used for farm purposes, and unless the canvas is to be subjected to a proofing treatment, it is recommended that only mineral-dyed khaki be bought for out-of-door use.

It is more economical to buy a good grade of duck, even at a decidedly higher first cost, than a cheap duck of light weight and poor construction.

Mildew and sunlight are the chief causes for the deterioration of cotton duck. Untreated duck always mildews in warm weather if stored wet or even slightly damp. To prevent mildewing, the canvas should be thoroughly dried in the open air before it is folded and stored. Sunlight causes rapid deterioration of untreated duck and even more rapid deterioration of duck subjected to certain treatments. Pigments tend to prevent such deterioration.

Treatments which decrease the absorption of water by canvas usually increase its mildew resistance. In humid climates or seasons, or under conditions of service where the canvas remains wet or moist for several days at a time, a treatment which will decrease water absorption should be applied.

Satisfactory results for increasing the serviceability of cotton duck have been obtained with the formulas given in this bulletin. One coat applied to one side of the canvas usually is sufficient.

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WATERPROOFING AND MILDEWPROOFING OF COTTON DUCK

By H. P. Holman, *Senior Chemist*, and T. D. Jarrell, *Associate Chemist, Industrial Farm Products Division, Chemical and Technological Research, Bureau of Chemistry and Soils*

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USE OF COTTON DUCK

COTTON DUCK, otherwise known as canvas, is used extensively for the protection of machinery, sacked grain, shocks, stacks and ricks, for wagon and truck covers, for awnings and temporary shelters, for horse covers, and for catching grain which falls to the ground during threshing. Undoubtedly it would be used to a greater extent if it fulfilled more effectively these various purposes and if it retained its serviceability for a longer period than it ordinarily does.

This bulletin tells how to select and care for duck or canvas on the farm and describes simple methods for prolonging its period of serviceability by the application of waterproofing and mildewproofing treatments.

CLASSES OF COTTON DUCK

Two general classes of cotton duck are known to the cotton-goods trade. They are "numbered duck" and "ounce duck."

"Numbered ducks" are made of multiple-ply yarns in both the warp and filling directions. The numbers run down, and the weights up, from 12 to 0 (or more ciphers), with a difference in weight between the consecutive numbers of 1 ounce per linear yard 22 inches wide. The canvas can be bought in widths of from 22 to 144 inches. No. 12 duck, which is the lightest of this class, weighs 7 ounces per linear yard 22 inches wide, or about 11.5 ounces per square yard. No. 00 duck, the heaviest commonly used, weighs 20 ounces per linear yard 22 inches wide, or about 32.7 ounces per square yard.

"Ounce ducks" are usually from 28½ to 30 inches wide and weigh from 6 to 15 ounces per linear yard. There are three grades or qualities of ounce ducks:

(1) **United States standard Army duck.**—This is the best grade of light and medium-weight duck on the market. It is made of multiple-ply yarns both in the warp and filling directions, and is not bleached, loaded, or sized. (Figs. 2, 4, 6, and 13.)

(2) **Double-filled duck.**—The warp consists of single-ply yarns and the filling of multiple-ply yarns. (Figs. 7, 9, 11, and 14.)

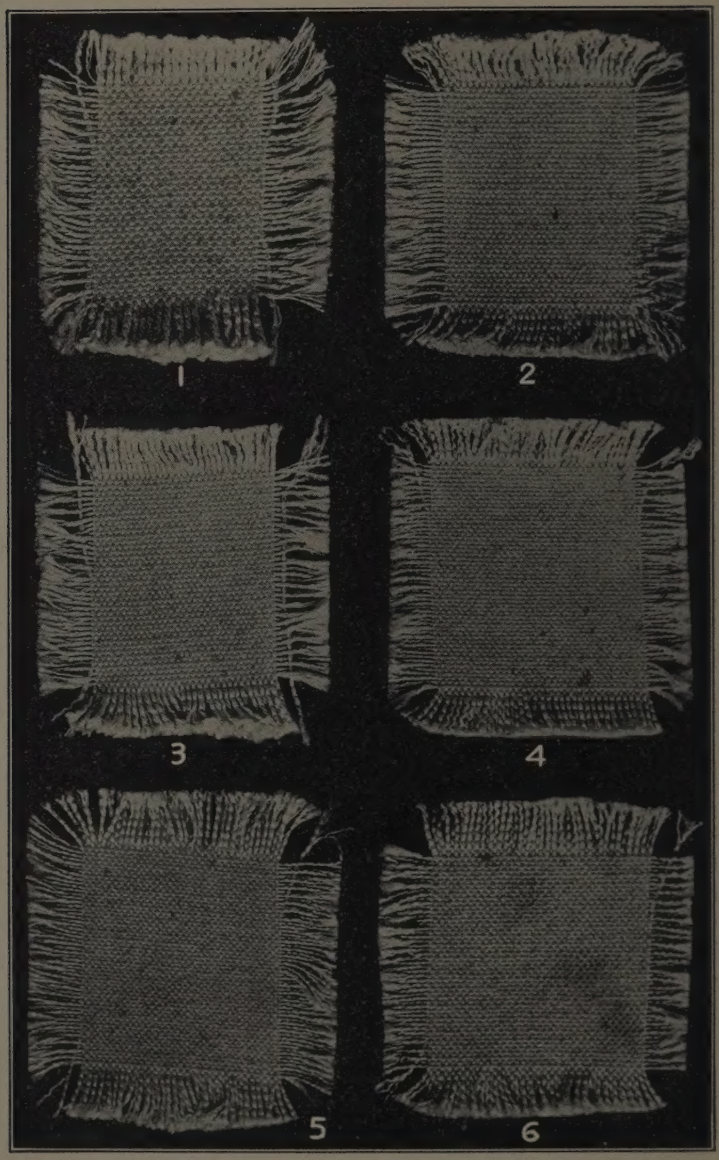

FIGURE 1.—No. 8 duck
FIGURE 2.—15-ounce United States standard Army duck
FIGURE 3.—No. 10 duck
FIGURE 4.—12-ounce standard Army duck
FIGURE 5.—No. 12 duck
FIGURE 6.—10-ounce United States standard Army duck

(3) **Single-filled duck.**—Both the warp and filling are made of single-ply yarns. This is the cheapest and poorest grade of duck on the market. (Figs. 8, 10, and 15.)

In both the double-filled and single-filled ducks the filling yarns are much heavier than the warp yarns. In order to make a canvas of more uniform appearance, therefore, the warp yarns are usually woven in pairs, resulting in a loosely woven duck which has little water resistance and can not be as thoroughly waterproofed as the multiple-ply ducks.

Moreover, the sizing used in weaving these ducks with single-ply warp adds temporary weight to the fabric, which is soon lost on weathering, and increases its water-absorption and susceptibility to mildew. For these reasons, such ducks are not recommended for out-of-door use.

SELECTION OF COTTON DUCK FOR FARM USE

For farm purposes only bleached, unsized, closely woven duck should be used. It should not be too stiff, however, nor so closely woven that it has no flexibility when wet and cold, in which case it has a tendency to crack when creased or folded. Furthermore, stiff canvas is very difficult to handle, and, when used as a cover, does not shape itself properly to objects, as a result of which it does not give them adequate protection. For horse covers a moderately stiff canvas is preferable, as it does not lie close to the body of the animal and does not cause sweating as readily as the more flexible material.

Large covers or paulins.—These should be made of No. 8 duck, which weighs about 18 ounces per square yard, or of 15-ounce United States standard Army duck, weighing about 18.9 ounces per square yard. (Figs. 1 and 2.)

Wagon and machine covers.—Either No. 10 or 12-ounce United States standard Army duck is suitable for this purpose, as both have sufficient body without being too stiff when wet. No. 10 duck weighs about 14.7 ounces and 12-ounce United States standard Army duck about 15.2 ounces per square yard. (Figs. 3 and 4.)

Hay caps and other small covers.—No. 12 duck, weighing about 11.5 ounces per square yard, or 10-ounce United States standard Army duck, weighing 12.6 ounces per square yard, is satisfactory for this purpose. (Figs. 5 and 6.) Although not so durable, lighter-weight fabrics such as 7-ounce or 8-ounce khaki Army duck, or even closely woven unbleached sheeting that has been waterproofed, can be used for hay caps.

Awnings.—Eight-ounce duck is sufficiently heavy for this purpose. Khaki Army duck, either plain or decorated with painted stripes, is more serviceable than ordinary awning ducks.

Tents.—Ten-ounce United States standard Army duck is suitable for medium-sized tents that are used occasionally for comparatively short periods of time. For large tents or tents that are used continuously 12-ounce Army duck is more serviceable. Shelter-tent duck is very suitable for lightweight auto tents.

It is more economical to buy a good grade of duck, even at a decidedly higher first cost, than a cheap duck which is poorly constructed and will not prove serviceable.

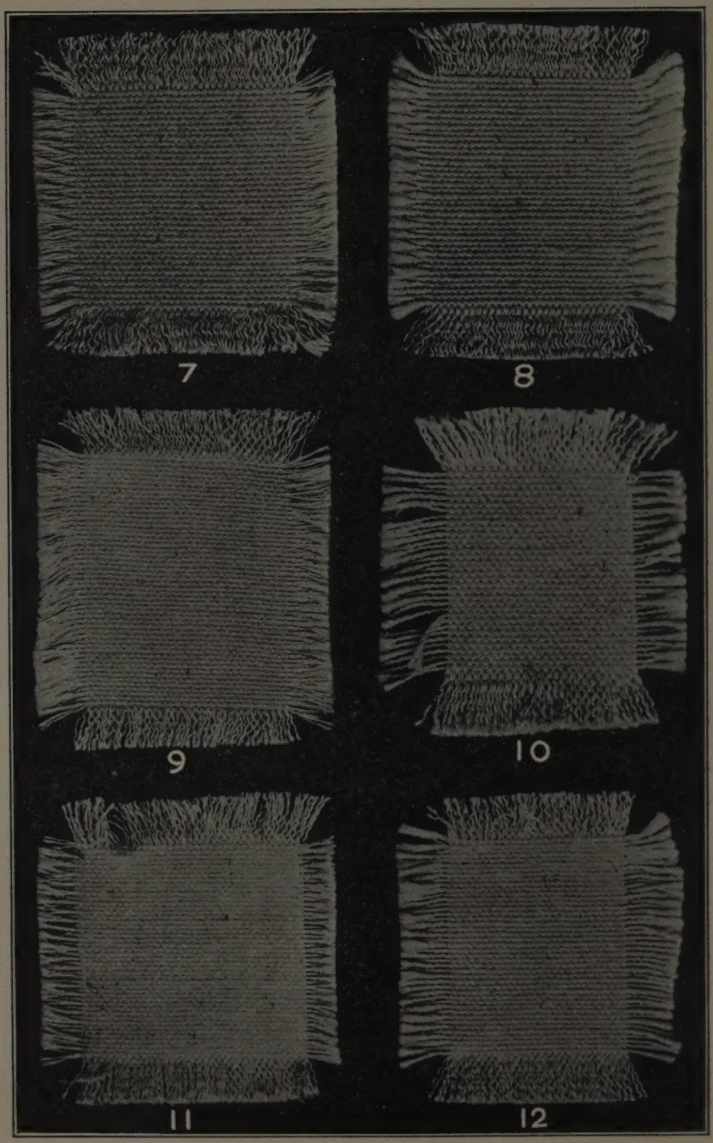

FIGURE 7.—15-ounce double-filled duck
FIGURE 8.—15-ounce single-filled duck
FIGURE 9.—12-ounce double-filled duck
FIGURE 10.—12-ounce single-filled duck
FIGURE 11.—10-ounce double-filled duck
FIGURE 12.—10-ounce single-filled duck

Duck which when held up to the light shows numerous pinholes or thin places does not make good covers, although a few small pinholes may be expected. The best duck is made from multiple-ply yarn, and the weave is moderately hard. The ply of the yarns can be determined by untwisting them and counting the number of small threads into which they separate. To ascertain the closeness of the weave, the duck may be unraveled on two adjacent sides and the number of ends of yarn in a measured inch on each side counted. Warp threads run in the long direction of the goods; filling threads run across the goods.

General observation has shown that cotton duck which has been dyed a khaki color with mineral dyes is more durable than the white untreated duck. It is somewhat mildew resistant and remains so for a long time if the dyeing process has been properly conducted. Unless the canvas is to be subjected to a proofing treatment, it is recommended that only mineral-dyed khaki canvas be bought for severe service. A khaki color may be obtained also by the use of organic dyes, but the mineral-dyed fabric is much to be preferred. The following very simple test will suffice to determine whether the fabric has been dyed with organic dyes or with mineral dyes:

Burn a piece of duck until no carbon is left in the ash. If mineral dyes have been used, an appreciable amount of ash, colored from buff to dark brown, will be present; if organic dyes have been used, only a small amount of a white to gray ash will remain.

FIGURE 13.—8-ounce U. S. standard Army duck
FIGURE 14.—8-ounce double-filled duck
FIGURE 15.—8-ounce single-filled duck

CARE OF COTTON DUCK

The deterioration of cotton duck is due to a number of causes other than use. One is mildew, which usually appears when the canvas remains damp for several days in warm weather. Mildew is readily recognized by the appearance on the canvas of white, black, yellow, pink, or green spots, varying in size from that of a pinhead to that of a 5-cent piece. Canvas may be injured also by bacterial action, which produces no marked change in the color but weakens the entire fabric. This occurs when the canvas has lain for some time in contact with the ground or a damp floor. In addition canvas may be weakened by the chemical action of materials in it or simply by exposure to sunlight.

White untreated cotton duck mildews very quickly under certain conditions, such as warmth, absence of light, and a moist atmosphere. Canvas which is folded and stored wet or even slightly damp usually is more or less mildewed when taken out, especially if it has been put in a rather warm, dark place. Such canvas is much weakened and leaks in the mildewed places, so that if not totally useless when first taken out it soon becomes so in service and must be replaced.

Canvas which has become wet or even damp should be dried as soon as possible by being spread out over a wagon or hung over a wooden fence or a large pole, preferably in the sunshine, until it is thoroughly dry. If the weather is wet, it may be hung under a shed or in the barn. No canvas, bags, etc., should be folded or stored while damp. Folding of heavy canvas, especially if it has been stiffened by a waterproofing treatment or by being wet or frozen, may weaken or crack the fabric, causing it to leak. For this reason heavy canvas when not in use should hang over a beam or large horizontal pole, or should be suspended against the inside of a barn or shed rather than folded.

WATERPROOFING AND MILDEWPROOFING COTTON DUCK

Cotton duck, or canvas, which has been given no special treatment sheds water to some extent as long as it does not mildew, especially if it is closely woven and shows but few pinholes when held up to the light. Its water resistance in the untreated condition is sufficient for awnings, pavilions, fixed wagon covers, tents, large umbrellas, or other uses where the fabric is not in a horizontal position and where it is not in contact with objects beneath it. Untreated canvas does not owe its serviceability for such purposes to the fact that it does not become wet. Except in the case of new and unbleached fabrics, where the natural oils and waxy substances of raw cotton fiber as well as oils applied to the yarn during spinning and weaving are still present, cotton fabrics have high water absorption, and canvas used for any of the purposes mentioned will be found to be soaked with water after a rain.

In general, it may be said that the danger from mildew increases with the tendency of the canvas to become wet, unless some substance which is decidedly poisonous to mildew is present. Where the wet canvas remains exposed to the light and air, so that it can dry in a reasonably short time, there is little necessity for treatment to prevent mildew. In humid climates or seasons, or under conditions of service where the canvas remains wet or moist for several days at

a time, however, treatments which will decrease the rate of water absorption, at the same time decreasing the susceptibility to mildew, should be applied. Another reason for applying waterproofing treatments is that untreated canvas brought in contact, especially moving contact, with objects beneath it does not shed water satisfactorily.

White untreated canvas remains serviceable for from one to five years, or occasionally longer, depending upon its quality, the conditions under which it is used, and the care taken to keep it from mildewing. As previously stated, canvas dyed a khaki color with mineral dyes lasts longer than white untreated canvas under the same conditions. Since it is sometimes difficult to obtain khaki-colored canvas and not always possible to exercise proper and timely care of canvas articles, treatments which will increase the serviceability of white duck are desirable. Proper treatments increase the usefulness and more than double the period of serviceability of white canvas. Treated canvas and commercial preparations for treating canvas may sometimes be obtained from tent and awning dealers, but should never be purchased without some satisfactory evidence of the merit of such treatments.

The most common of the several existing types of waterproofing processes are: (1) Those in which the water resistance is due to insoluble metallic soaps or other insoluble metallic compounds, as, for example, aluminum soap, basic acetate of aluminum, mineral khaki, and cuprammonium treatments; (2) those depending upon the use of paraffin or mixed waxes; (3) those depending upon the use of bituminous materials, such as asphaltum or tar; (4) those depending upon the use of linseed oil or other drying oils; (5) those where combinations of the processes of types 1, 2, 3, and 4 are used.

By some treatments, such as cuprammonium, substances which are poisonous to mildew growth are left on the canvas. Practically complete mildew resistance may be obtained by means of the cuprammonium treatment, but this treatment and many others are not adapted to home application. Mildew resistance can be secured best in home treatments by the application of materials which are effective waterproofing agents but contain no food for the mildew organisms, or by the incorporation in the waterproofing materials of fungicides which retard decidedly the development of mildew growth. Among such fungicides the most readily available are dry Bordeaux mixture and Paris green, but the use of these substances is attended with considerable danger, as they may dust off the fabric and be inhaled or contaminate foodstuffs. It is advisable to avoid treatments with paraffin wax, as they give canvas undesirable physical properties which seem to make it more, rather than less, susceptible to the action of mildew.

It has been found that some waterproofing treatments, particularly those in which materials of an oily, greasy, or waxy character are used, cause cotton duck to lose strength very rapidly when exposed to sunlight. Untreated 12-ounce Army duck may lose about 40 per cent of its strength as a result of exposure to the weather for six months during the warmer part of the year. Duck treated with linseed oil may lose 65 per cent or more of its strength when similarly exposed, and duck treated with materials consisting mostly of paraffin, petrolatum, or petroleum grease may lose from 80 to 90 per

cent of its strength when exposed under the same conditions. Canvas treated with waterproofing preparations containing certain pigments such as lampblack and the earth pigments (ocher, sienna, and umber) does not lose so much of its strength when exposed to the weather. For this reason it is advisable to add an opaque pigment to any waterproofing preparation to be used on canvas that will be exposed to the weather continuously or frequently. If a commercial preparation is to be used it is best to select one that will color the fabric distinctly and permanently.

FORMULAS

In formulas for home use in waterproofing canvas the choice of materials is necessarily limited to those that are generally available or that can be procured in moderately small quantities with little effort and at fairly low cost.

Waterproofing treatments prepared according to the following formulas have been found satisfactory for increasing the serviceability of cotton duck, and it is believed that they will meet the requirements of the farmer and ranchman and others using canvas for outdoor purposes.

For canvas paulins or large portable covers—

FORMULA 1

Petrolatum (vaseline), dark or amber	pounds	8½
Beeswax, yellow refined	do	1½
Earth pigment, dry (ocher, sienna, or umber)	do	5
Volatile mineral spirits (painters' naphtha)	gallons	5

FORMULA 2

Petroleum asphalt, medium hard	pounds	7½
Petrolatum, dark or amber	do	2½
Lampblack, dry	do	1
Volatile mineral spirits (painters' naphtha)	gallons	5

The quantities specified are sufficient to treat about 40 square yards of canvas on one side.

A mixture of 3 gallons of gasoline and 2 gallons of kerosene can be substituted for the volatile mineral spirits, but will evaporate more slowly. Canvas treated according to the first formula will be colored buff by ocher, khaki by raw sienna, drab by raw umber, and brown by burnt umber. If a white treatment is preferred, use dry zinc oxide in place of earth pigment. For some purposes, formula 1 with a light-colored pigment will be preferable to formula 2, because canvas treated with the latter will absorb more heat from sunlight, owing to its black color.

For permanently fixed canvas covers—

FORMULA 3

Boiled linseed oil	gallon	1
Lampblack, ground in linseed oil	pounds	2
Japan drier	pint	1

FORMULA 4

Boiled linseed oil	gallon	1
Aluminum bronzing powder	pound	1
Japan drier	pint	½

For lightweight fabrics not continuously or frequently exposed to sunlight—

FORMULA 5

Beeswax, yellow refined	pound	½
Spirits of turpentine	gallon	1

Petrolatum and beeswax can be purchased from druggists or from wholesale dealers in druggists' supplies. Petroleum asphalt can sometimes be supplied by dealers in roofing materials or can be ordered from refiners of asphaltic base petroleum. The other materials specified in the formulas can be obtained from paint stores.

MIXING THE MATERIALS

In the preparation of waterproofing solutions according to formulas 1, 2, and 5, place the specified weights of waterproofing materials in a suitable metal container and melt slowly and carefully at as low a temperature as possible, with constant stirring. Then remove to a place where there is good ventilation and no fire or open flame and pour the melted material into the solvent while stirring. When a pigment is used, thin the pigment in a separate container by mixing with it small additions of the liquid, and when the pigment mixture is sufficiently thinned strain it through fine-mesh wire screen or several thicknesses of cheesecloth into the waterproofing liquid. In formulas 3 and 4 the pigments should be thinned in a similar manner with linseed oil before they are added to the bulk of the oil.

When the waterproofing material settles to the bottom of the container or thickens, it will be necessary to warm the mixture just before applying it to the canvas. This must be done in the open air by placing the container in a tub or can of hot water. Be sure that the container is open, and *never place it over or near a flame.*

APPLICATION

The mixture must be thoroughly stirred before and during application, in order to keep the undissolved material in suspension. These preparations may be applied to the canvas by means of a paint brush or by spraying. Wagon covers, shock covers, etc., may be treated best by stretching the canvas against the side of a barn or attaching it to a frame and applying the material with a brush. Once the canvas is fixed in position, no more time is required to treat it than is necessary to apply a first coat of paint to a rough board siding having the same area. Much time may be saved in treating large paulins and standing tents by applying the material with a spray pump, with which a pressure of at least 50 pounds is developed. Some loss of material, however, results from this method.

The experience of the Department of Agriculture has been that one coat applied to one side of the canvas usually is sufficient. With one coat applied to one side, using the strength of solution as given in the formulas, there will be an increase in weight of approximately 40 to 50 per cent when formula 1 or 2 is used. When formula 3 or 4 is used the fabric will gain about 75 per cent in weight. When formula 5 is used the gain in weight will be around 10 per cent.

When canvas is treated with linseed-oil preparations it should be allowed to dry thoroughly (for two or three weeks) while freely exposed to the air. If folded and stored in a warm place before drying is complete the accumulated heat from continued oxidation may result in spontaneous combustion.

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